CLAIMS

What is claimed is:

1. An apparatus for reducing the parachuting of a probe measuring the topography of a surface comprising:

an oscillating probe;

a phase detection circuit coupled to the oscillating probe; and

a probe drive boosting circuit coupled to the phase detection circuit and the probe,

wherein the phase detection circuit detects a reduction of a variation of a phase signal from the probe and the probe drive boosting circuit boosts a signal to the probe based on the phase signal detected by the phase detection circuit to produce a boosted probe drive signal.

2. The apparatus according to claim 1, wherein the phase detection circuit comprises:

a precision full wave rectifier; and

an envelope detector coupled to the precision full wave rectifier,

wherein the precision full wave rectifier rectifies a phase signal of the probe to produce a rectified phase signal and the envelope detector detects the rectified phase signal to produce an envelope detected signal.

3. The apparatus according to claim 2, wherein the phase detection circuit further comprises:

a comparator coupled to the envelope detector; and

an event detector and hold off circuit coupled to the comparator,

wherein the comparator and the event detector and hold off circuit generate an event signal from the envelope detected signal.

4. The apparatus according to claim 3, wherein the phase detection circuit further comprises a multiplier coupled to the event detector,

wherein the multiplier combines the event signal with a probe drive signal to produce the boosted probe drive signal.

5. The apparatus according to claim 3, wherein the phase detection circuit further comprises:

a multiplier coupled to the event detector; and

a control module, wherein the multiplier combines the event signal with a gain setting in the control module to increase error integration.

6. The apparatus according to claim 4, further comprising an event level setting circuit coupled between the event detector and hold off circuit and the multiplier, wherein the event level setting circuit sets an event level of the event signal.

7. The apparatus according to claim 4, wherein the boosted probe drive signal is boosted 20 to 30 percent of the probe drive signal above the probe drive signal.

8. The apparatus according to claim 3, wherein the event detector and hold off circuit delays the generation of the event signal for a predetermined time.

9. A method for reducing the parachuting of a probe obtaining accurate information representative of a surface of a sample comprising:

scanning the surface of the sample with an oscillating probe;

detecting a reduction of a variation of a phase signal of the probe indicative of free oscillation of the probe; and

reducing a distance between the probe and the sample in response to the detection of the reduction of the variation of the phase signal of the probe.

10. The method according to claim 9, wherein the detecting step further comprises:

rectifying the phase signal of the probe to produce a rectified phase signal; and

envelope detecting the rectified phase signal of the probe to produce an envelope detected phase signal of the probe.

11. The method according to claim 9, wherein the reducing step further comprises boosting a drive signal of the probe to produce a boosted drive signal of the probe.

12. The method according to claim 11, wherein the detecting step further comprises triggering an event signal based on the detected phase signal and the boosting step further comprises boosting the drive signal of the probe by combining the event signal with the drive signal of the probe to produce a boosted drive amplitude signal.

13. The method according to claim 12, wherein the detecting step further comprises delaying the triggering of the event signal for a predetermined time.

14. The method according to claim 11, wherein the boosted drive signal is 20 to 30 percent of the drive signal above than the drive signal.

15. The method according to claim 9, further comprising:

detecting an error signal of the probe when the oscillating amplitude of the probe is too high; and

accumulating the error signal of the probe.

16. The method according to claim 9, further comprising:

detecting an error signal of the probe when the oscillating amplitude of the probe is too small; and

accumulating the error signal of the probe.

17. The method according to claim 9, wherein the detecting step detects a reduction of a variation of a phase signal when the phase difference between a sinusoidal drive and a probe response signal is substantially 90 degrees.

18. The method according the claim 9, wherein the reducing step further comprises boosting a drive signal of the probe to increase the accumulation of an error signal of the probe.

19. An apparatus for reducing the parachuting of a probe measuring the topography of a surface comprising:

an oscillating probe;

parachuting detection circuitry coupled to the oscillating probe

parachuting reduction circuitry coupled to the parachuting detection circuitry, wherein the parachuting reduction circuitry reduces the parachuting of the probe in response to the detection of parachuting of the probe.

20. The apparatus according to claim 19, wherein the parachuting detection circuitry comprises a phase detection circuit and the parachuting reduction circuitry comprises a probe drive boosting circuit.